

Regional Trends in Remedy Changes

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ACRONYMS

ARAR Applicable or Relevant and Appropriate Requirement

CD Consent Decree

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CERCLIS 3 Comprehensive Environmental Response, Compensation, and Liability Information System 3

DNAPL Dense Non-Aqueous Phase Liquid

EPA Environmental Protection Agency

ESD Explanation of Significant Differences

FY Fiscal Year

NCP National Contingency Plan

NPL National Priorities List

OSRE Office of Site Remediation Enforcement

OU Operable Unit

PRP Potentially Responsible Party

RA Remedial Action

RD Remedial Design

RD/RA Remedial Design/Remedial Action

RI/FS Remedial Investigation/Feasibility Study

ROD Record of Decision

TAG Technical Assistance Grant

UAO Unilateral Administrative Order

INTRODUCTION

EPA's Office of Site Remediation Enforcement (OSRE) manages a national enforcement and compliance program under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). As part of this program, OSRE is responsible for ensuring that settlements with potentially responsible parties (PRPs) for remedial action at National Priorities List (NPL) sites are consistent with EPA policies. Concerns have been raised that PRPs and EPA regions privately negotiate changes in previously selected remedies, presumably in some cases as part of *quid pro quo* arrangements in which PRPs receive an agreement to modify the selected remedy in return for their agreement to undertake a cleanup.

The primary purpose of this study was to examine historical data on remedy changes, at both the national and regional levels, for evidence of a pattern of more frequent remedy changes at operable units (OUs) where PRPs settled and undertook cleanups than at OUs where EPA undertook cleanups. The study compares the rate of remedy changes at PRP-lead OUs with the rate at Fund-lead OUs (where EPA undertook cleanups without PRP involvement). This report summarizes the data collected, discusses the methodology used in determining whether the rates of Fund-lead and PRP-lead remedy changes are significantly different, and discusses regional trends in remedy changes.

The remainder of this report is divided into four sections. Section 1 describes the various categories of remedy change, the public participation requirements associated with each, and the Superfund Administrative Reforms that affect remedy change use. Section 2 discusses the nature of the data gathered for this study, the subset of those data used for comparing the rates of remedy changes, and the methods used to make that comparison. Section 3 presents and discusses the data on the use of remedy changes over the history of the Superfund program, compares the rates of remedy change use at PRP-lead OUs with the rates at Fund-lead OUs, discusses the reasons remedy changes are made, and discusses community participation in the remedy change process. Section 4 briefly summarizes the results and findings of the study.

1.0 RECORDS OF DECISION (RODs) AND REMEDY CHANGES IN THE SUPERFUND PROCESS

1.1 RODs and Public Participation

Section 117 of CERCLA and the National Contingency Plan (NCP)¹ require EPA (or other lead agency, such as a state) to provide for public participation in the remedy selection process. Before selecting a remedy, EPA must present its preferred remedial action alternative to the public in a proposed plan. Notice of availability of the proposed plan must be published in a major local newspaper of general circulation. The proposed plan and supporting analysis and information must be made available in the Administrative Record. EPA must provide at least 30 calendar days for submission of written or oral comments on the proposed plan and supporting analysis and information located in the information repository, including the remedial investigation/feasibility study (RI/FS). Upon timely request, EPA must extend the public comment period by a minimum of 30 days. In addition, EPA must provide the opportunity for a public meeting to be held during the public comment period. Only after these requirements are met and issues raised by the public have been considered and appropriately addressed does EPA adopt the selected remedy in a record of decision (ROD). The ROD must be accompanied by a responsiveness summary that summarizes comments, criticisms, and new relevant information submitted during the public comment period, and provides EPA's response to each issue.

In February 1995, EPA announced twelve initiatives designed to strengthen and improve the Superfund program. Two of the initiatives, the Community Advisory Groups/Technical Assistance Grants initiative and the Community Involvement in the Enforcement Process initiative, were designed to expand efforts to ensure that cleanup objectives are responsive to the needs of the communities served, and to provide greater public participation by providing community members with: (1) a forum to present and discuss their concerns about the Superfund decisionmaking process; (2) grants for hiring technical advisors to help community members understand the technical issues and improve their ability to articulate any concerns; and (3) an opportunity to be involved in the process as early as possible to give them ample time to provide input and to communicate with PRPs.

1.2 Post-ROD Remedy Changes

After signing a ROD, EPA sometimes receives information that supports modifying or completely changing the selected remedy. Such information can come from the public, PRPs (including other federal agencies), support agencies such as states or tribes, or may simply be generated during the remedial design/remedial action (RD/RA) process. After considering the information, EPA may conclude that it warrants a change in the selected remedy. Section 117(c) of CERCLA provides that, if a remedial action, enforcement action, or settlement "differs in any significant respects" from a previously signed ROD, EPA "shall publish an explanation of the significant differences

¹ 40 C.F.R. § 300.430(f)(3).

and the reasons such changes were made.” The NCP² and EPA guidance³ elaborate on this requirement, creating three categories of remedy changes, each with more extensive public participation requirements. Non-significant changes to the remedy are addressed with a memorandum to the file, significant remedy changes with an explanation of significant differences (ESD), and fundamental remedy changes with a ROD amendment.

1.2.1 Non Significant Changes: File Documentation

Minor changes to the selected remedy do not rise to the level of “significance” described under CERCLA section 117(c), and consequently do not require formal public notice. Such non-significant changes typically occur as part of the RD/RA engineering process. They include minor changes to the type or cost of materials, equipment, facilities, services, or supplies used to implement the remedy. Minor refinements of time or cost estimates during the RD/RA process are not considered significant differences. Non-significant remedy changes are documented by a memorandum or note placed in the post-ROD document file. If EPA chooses, non-significant changes may be documented for the public in a Remedial Design Fact Sheet.

1.2.2 Significant Changes: Explanation of Significant Differences (ESDs)

When EPA makes a significant change to the scope, performance, or cost of a remedy, but the change does not fundamentally alter the overall remedial approach, EPA is required to prepare an ESD. The ESD describes the remedy previously selected in the ROD, the information that warranted a change in that remedy, and how the scope, performance, or cost of the remedy will be changed. A notice of availability and a brief description of the ESD must be published in a local newspaper of general circulation, and the ESD must be made available to the public as part of the administrative record for the site. EPA may choose to hold a formal public comment period or public meeting about an ESD, but it is not required to do so. EPA guidance explicitly recognizes that ESDs may arise from PRP negotiations to undertake the RD/RA. When an RD/RA consent decree includes significant changes to a component of a remedy, the ESD is prepared and issued concurrently with the consent decree. The public is then given an opportunity to comment on the consent decree and accompanying remedy changes before EPA seeks to have the consent decree entered by a U.S. District Court.

1.2.3 Fundamental Changes: ROD Amendment

When EPA makes a fundamental change to the hazardous substance management approach selected in the ROD, the Agency is required to issue a revised proposed plan, followed by a ROD amendment. Examples of fundamental remedy changes include changing from a technology that

² 40 C.F.R. § 300.435(c)(2).

³ OSWER Directive 9355.3-02, “Interim Final Guidance on Preparing Superfund Decision Documents,” Ch. 8 (October 1989).

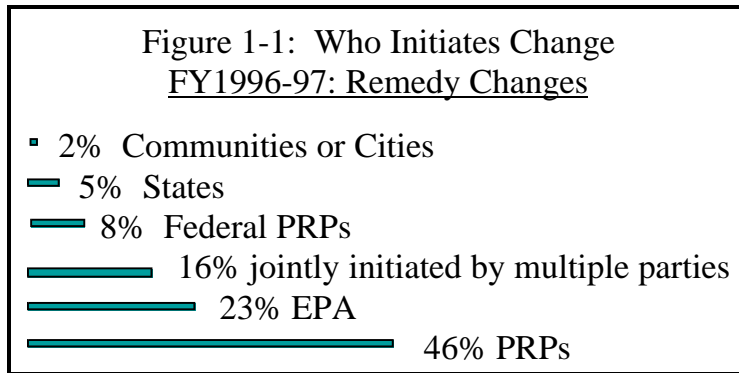
has not performed satisfactorily in pilot scale testing to a more proven technology, or switching from a thermal destruction remedy to bioremediation because contaminant concentrations are determined to be lower than previously thought. The public participation requirements for ROD amendments are the same as those for the original ROD. As in the ESD process, public participation for ROD amendments arising from RD/RA settlement negotiations is coordinated with the consent decree public participation process.

1.3 The Updating Remedy Decisions Reform

In October 1995, as part of the third round of Superfund Administrative Reforms, EPA announced initiatives to make smarter cleanup choices. The Updating Remedy Decisions Reform was designed to revisit remedy decisions at certain Superfund sites where significant new scientific information or technological advancements will achieve the same level of protectiveness of human health and the environment at a lower cost than the remedy originally selected. Each EPA region is encouraged to review and modify past remedy decisions in response to advances in remediation science and technology. The guidance “Superfund Reforms: Updating Remedy Decisions” (September 27, 1996) targeted three types of remedy changes: (1) changes in the remediation technology, where a different technology would result in a more cost-effective cleanup; (2) reconsideration of remediation objectives in light of the nature of the contamination or physical limitations posted by site conditions, such as sites where achieving the selected groundwater cleanup level is technically impracticable (e.g., because of the presence of dense non-aqueous phase liquids (DNAPLs)); and (3) modification of monitoring programs that can be streamlined without compromising the effectiveness or protectiveness of the remedy.

This reform does not change the substantive or procedural standards applicable to RODs and remedy changes. Remedy changes resulting from the reform are documented in ROD amendments, ESDs, and memoranda to the file, in the same way that remedy changes were documented before the reform. The degree to which remedies must protect human health and the environment remains the same, as do other site cleanup requirements, such as those relating to the preference for permanence, establishment of cleanup levels, and compliance with applicable or relevant and appropriate requirements (ARARs). The opportunities for public and PRP participation in the remedy change, as described above, are unchanged by the reform.

A report about the implementation of the Updating Remedy Decisions reform, entitled “Updating Remedy Decisions at Select Sites, Summary Report, FY 1996 and FY 1997” (July 1998), surveyed 148 remedy changes (Fund-lead and PRP-lead) that took place in fiscal year (FY) 1996 and FY 1997. The report confirmed that the public participation requirements associated with remedy changes generally were being followed. Many of the remedy changes were of the types addressed by the reform, and the remedy changes resulted in estimated savings of more than \$350 million in FY 1996 and more than \$390 million in FY 1997. The report also classified the parties initiating remedy changes (shown in Exhibit 1-1).



As the report noted, the approximately 2:1 ratio of remedy changes initiated by PRPs to those initiated by EPA is consistent with recent ratios of PRP-lead to Fund-lead RD/RAs (approximately 70% PRP-lead to 30% Fund-lead). The report also noted that most remedy changes result from information generated during the remedial design (RD) process, and not after remedies have been constructed.

2.0 METHODOLOGY

2.1 DATA COLLECTION

2.1.1 Nature of Data Collected

The remedy selection process often breaks up sites into several operable units to organize and facilitate the response, developing a separate ROD for each OU at the site.⁴ Remedy changes, which modify RODs, are also specific to OUs. Because both RODs and remedy changes typically apply to OUs rather than entire sites, this study is also focused at the OU level. Data were gathered for each ESD and ROD amendment completed since the advent of the Superfund program. The data set was assembled in two phases. In 1995, data was gathered for all remedy changes made up to that time. In 1998, the data set was updated to include remedy changes made between 1995 and July 1998.

A data summary was created for each remedy change. Data about the history of each OU to which a remedy change applied was obtained from the CERCLIS 3 database. Where possible, data about the nature of the remedy change were obtained from the text of the ESD or ROD amendment. Some remedy change texts were available in EPA's RODs database, while others were obtained from the regions. Information about other remedy changes was taken from summaries contained in the Updating Remedy Decisions report. Some of the remedy change texts obtained were for remedy changes that had not been entered into the Comprehensive Environmental Response, Compensation, and Liability Information System 3 (CERCLIS 3) database. These remedy changes were added to the data set and historical data about their OUs were obtained from CERCLIS 3. A total of 34 remedy changes were added to the data set in this fashion.

EPA regional personnel reviewed the data for 1984-1995 remedy change OUs to confirm their accuracy. Data collection for 1995-1998 remedy change sites was limited to CERCLIS. After the 1998 data collection efforts were complete, the 1995 and 1998 data summaries were merged into a single set. Data summaries completed in 1995 were not updated in 1998. The data summaries were classified according to remedy change lead. For purposes of this study, a remedy change was considered PRP-lead if either the RD or the remedial action (RA) was PRP-lead. Remedy changes at State-lead operable units (a total of three ROD amendments and six ESDs) were included with the Fund-lead remedy changes.

2.1.2 Summarizing Data

Data collected from CERCLIS 3 included: site name; EPA identification number; OU number; original ROD date; ESD or ROD amendment date; RD/RA negotiation start date; RD/RA negotiation complete date; RD/RA settlement code; RD/RA settlement start date; RD/RA consent

⁴ Some RODs address more than one OU.

decree lodged date; RD/RA settlement complete date; RD start date; RD completion date; RA start date; and RA completion date.

Data summarized from the texts of remedy changes (or the Updating Remedies Reform report) included: nature of the original ROD remedy; nature of the remedy change; reason for the remedy change; impetus for the remedy change; and level of community or PRP involvement.

In contrast to the CERCLIS 3 data, which consists primarily of dates and codes, these text summaries consist of short paragraphs for each category for which data was available. The texts of remedy changes typically contain substantial information about each of these five categories except the impetus for the remedy change. The texts often provide little information on which to base a conclusion as to which party or parties provided the impetus for remedy changes. However, the Updating Remedies Reform report (discussed above in Section 2.2.1) provides summary data about which party initiated remedy changes for FY 1996 and 1997.

2.2 DATA ANALYSIS

Early in the history of the Superfund program, a relatively high proportion of RD/RAs were Fund-lead. As enforcement capabilities were developed and EPA's "enforcement first" policy took effect, PRPs began to undertake more cleanups. In recent years, the ratio of PRP-lead cleanups to Fund-lead cleanups has been approximately 70% to 30%. Consequently, the number of remedy changes at PRP-lead OUs is greater than the number of remedy changes at Fund-lead OUs. When comparing remedy changes at PRP-lead OUs with those at Fund-lead OUs, it is necessary to take the greater number of PRP-lead OUs into account by comparing the rate of remedy changes at PRP-lead OUs (i.e., remedy changes per OU) with the rate of remedy changes at Fund-lead OUs. If PRPs were exercising influence that caused EPA to agree to remedy changes at PRP-lead sites that EPA otherwise would not have done, one would expect to see a higher rate of remedy changes at PRP-lead OUs than at Fund-lead sites.

In order to remove possible complicating factors from the comparison of the rate of remedy changes at PRP-lead OUs with the rate at Fund-lead OUs, all remedy changes at PRP-lead OUs where PRPs undertook the cleanup under a unilateral administrative order (UAO) rather than a consent decree (CD) were removed from the data set used to calculate remedy change rates. The working relationship between PRPs and EPA at UAO sites might be significantly different from their relationship at CD sites. A total of 44 ESDs and 23 ROD amendments were removed from the data set used to calculate remedy change rates for this reason.

It is necessary for statistical purposes to link remedy changes to the OUs to which they apply. Remedy changes have been linked to OUs by placing the remedy changes in the data for the year in which remedial action started at an OU, without regard to the actual date of the remedy change. If remedy changes were not linked to RA start dates at OUs, the data used to calculate a remedy change rate (i.e., the number of remedy changes divided by the number of OUs) for a

given period of time might contain a remedy change, but not the OU to which that remedy change applied. For example, to calculate the ESD rate for FY97 one should divide the number of OUs with RA starts in 1997 into the number of ESDs that took place at those same OUs. It would be inappropriate to calculate the ESD rate by dividing the number of RA starts in 1997 into the number of ESDs signed in 1997 because some of the OUs with 1997 RA starts might have ESDs that were signed in other years. Similarly, some of the ESDs signed in 1997 might be for OUs with RA starts in other years.

The choice of RA starts as the action to which remedy changes are linked has the effect of eliminating from the data set OUs that have not advanced far enough through the Superfund process to have had an RA start.⁵ Counting only OUs with RA starts serves to eliminate from the data set both OUs that could not yet have had remedy changes because there is not yet any ROD to modify and OUs where the ROD is so recent that there has been little opportunity to revise it. Linking remedy changes to RA starts does result in the loss from the data set of some remedy changes that apply to OUs that have not yet had RA starts. A total of 31 ESDs and 23 ROD amendments were removed from the data set used to calculate remedy change rates for this reason. After removing remedy changes at UAO OUs and OUs without RA starts, 86 ROD amendments and 213 ESDs remained in the data set.

The RA start and remedy change data were arranged in tables as shown in Exhibit 2-1. Each table divides both PRP-lead and Fund-lead OUs into two groups: OUs at which there were remedy changes and OUs at which there were not any remedy changes. Where there were multiple remedy changes at one OU, they were included in the total number of remedy changes. For example, there were 548 PRP-lead OUs without ROD amendments⁶ and 49 with at least one ROD amendment, including three OUs with two ROD amendments. In order to take such multiple remedy changes into account, all 52 remedy changes were included in the table. This has the effect of increasing the total for the PRP-lead column to 600, three more than the 597 OUs for PRP-lead sites listed in Exhibit 3-2. The difference represents the number of OUs with multiple remedy changes. The example below is for all ROD amendments program to date that applied to OUs with RA starts:

⁵ In order to make the number of RA starts serve as a proxy for the number of OUs (the denominator in the rate calculations), only the first RA start at each OU has been counted.

⁶ This figure is for PRP-lead RA starts where the RA was conducted under a CD. It does not include 201 additional PRP-lead RA starts where the RA was conducted under a UAO because the corresponding remedy changes have been removed from the data set used to compare remedy change rates at PRP-lead and Fund-lead OUs.

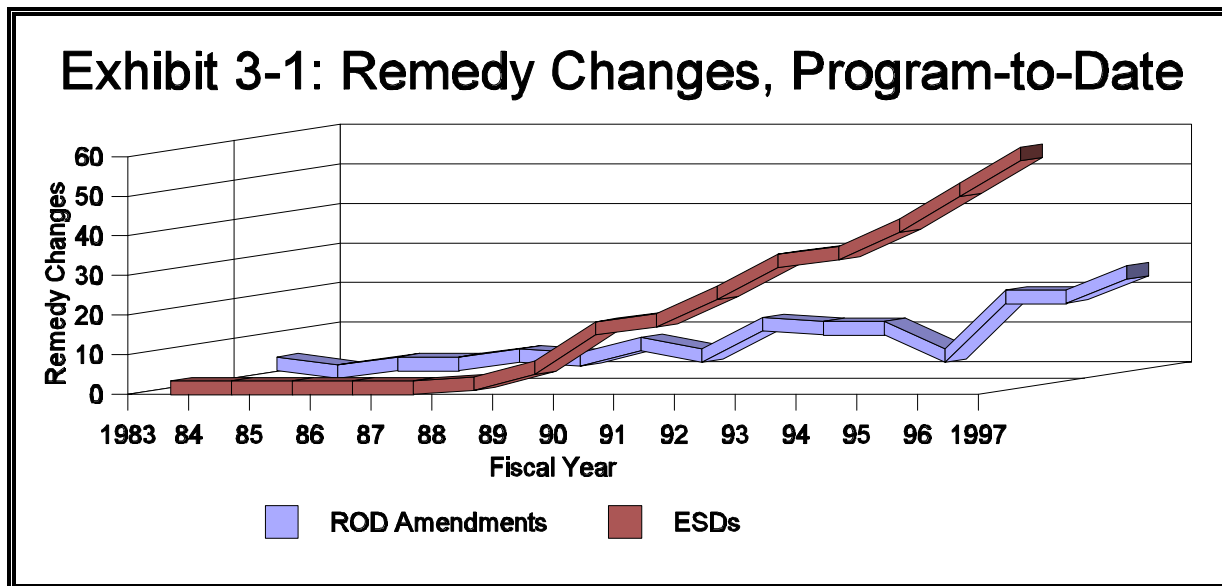
| Exhibit 2-1: ROD Amendments at OUs with RA Starts | | | |
|--|-----------|----------|--------|
| | Fund-lead | PRP-lead | Totals |
| No ROD Amendment | 358 | 548 | 906 |
| ROD Amendment | 26 | 52 | 78 |
| Totals | 384 | 600 | 984 |

The chi-square test of independence was used to determine if the difference in rates of PRP-lead and Fund-lead remedy changes shown in the tables are statistically significant. When there were subsets of data that were not large enough for use of the chi-square test, Fisher's test, which is more accurate for small samples, was used. The null hypothesis for the chi-square test was that there is no relationship between the lead at OUs and the rate of remedy changes (i.e., that the rate of remedy changes at PRP-lead and Fund-lead OUs is the same). The alternative hypothesis was that there is a relationship between the RD/RA lead at OUs and the rate of remedy changes. The same process was used to compare the rate of remedy changes for OUs at Federal Facilities to the rate at Fund-lead OUs. A 95% level of significance was used for all tests.

3.0 RESULTS AND FINDINGS

3.1 REMEDY CHANGE SUMMARY DATA

The Superfund program has signed a total of 132 ROD amendments and 288 ESDs. The use of remedy changes has grown from less than ten per year during the 1980s to an average of more than 40 per year during the 1990s.⁷ The growth in use of remedy changes in the 1990s parallels the growth in the number of Superfund sites that have progressed through the Superfund “pipeline” past the selection of remedies and into the RD/RA process during this decade. The Updating Remedy Decisions reform, which took effect in FY96, has probably also contributed to recent growth in the number of remedy changes. Fundamental changes in the selected remedy, requiring a ROD amendment, occur about half as often as significant remedy changes made using ESDs. These trends are apparent in Exhibit 3-1, which shows the number of ROD amendments and ESDs signed by year. Further detail on the distribution of remedy changes by region is available in Appendix A-1 (ROD Amendments) and Appendix A-2 (ESDs).



In contrast to the data shown in Exhibit 3-1 and Appendices A-1 and A-2, which include all ROD amendments and ESDs program-to-date, the remainder of the data presented and discussed in this report address a subset of remedy changes that have been adopted at OUs where RA starts have taken place without a UAO.

⁷ FY98 totals throughout this report include only data available as of July 1998. This partial data should not be compared to full-year totals for other years. FY98 data have been omitted from graphs.

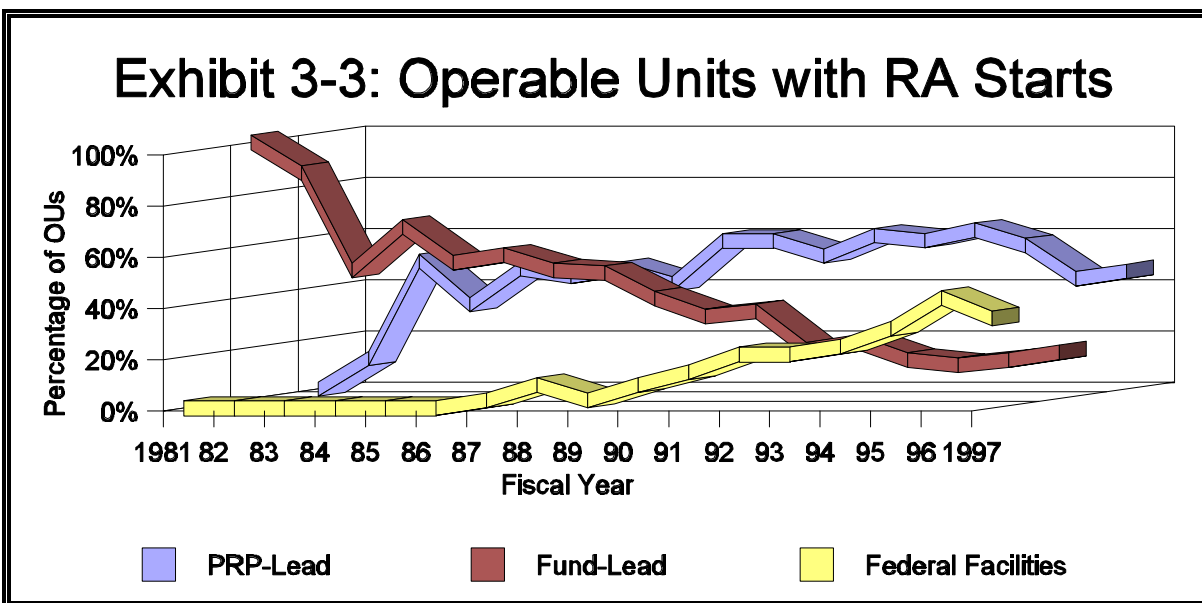
Exhibit 3-2 lists the number of RA starts for each year of Superfund program. The PRP-lead data have been divided to show both the number of RAs conducted under CDs and the number conducted under UAOs. RA starts, like remedy changes, did not occur in large numbers in the early days of the program, when few OUs were far enough along in the Superfund process to have had an RA start. In the 1990s, RA starts have become much more common, averaging nearly 150 per year.

Exhibit 3-2

Operable Units with RA Starts, by Lead

| Fiscal Year | Fund-Lead | PRP-Lead Under CD | PRP-Lead Under UAO | Federal Facilities | Totals |
|--------------------|------------------|--------------------------|---------------------------|---------------------------|---------------|
| 1981 | 1 | 0 | 0 | 0 | 1 |
| 1982 | 7 | 0 | 1 | 0 | 8 |
| 1983 | 4 | 4 | 0 | 0 | 8 |
| 1984 | 14 | 6 | 1 | 0 | 21 |
| 1985 | 9 | 7 | 1 | 0 | 17 |
| 1986 | 10 | 6 | 2 | 0 | 18 |
| 1987 | 32 | 26 | 4 | 2 | 64 |
| 1988 | 37 | 27 | 4 | 7 | 75 |
| 1989 | 38 | 46 | 10 | 3 | 97 |
| 1990 | 25 | 40 | 5 | 7 | 77 |
| 1991 | 42 | 52 | 13 | 18 | 125 |
| 1992 | 24 | 59 | 18 | 27 | 128 |
| 1993 | 31 | 60 | 23 | 30 | 144 |
| 1994 | 26 | 82 | 27 | 42 | 177 |
| 1995 | 23 | 66 | 31 | 54 | 174 |
| 1996 | 26 | 50 | 25 | 75 | 176 |
| 1997 | 29 | 45 | 28 | 55 | 157 |
| 1998 | 6 | 21 | 8 | 28 | 63 |
| Totals | 384 | 597 | 201 | 348 | 1530 |

Of all OUs with RA starts program-to-date, 52 percent were PRP-lead, 25 percent Fund-lead, and 23 percent Federal Facilities. In the first few years of the Superfund program, the few RA starts that occurred were predominantly Fund-lead. As EPA's enforcement program developed (and the nature of CERCLA liability and the advantages of settling rather than litigating became apparent to PRPs), PRP-lead cleanups became more common. During the second half of the 1980s, PRP-lead and Fund-lead cleanups were about equally common. Throughout this period, there were very few RA starts at Federal Facilities. As the Superfund program entered the 1990s, PRP-lead cleanup rates climbed to more than 50 percent under the "enforcement first" policy, while the Fund-lead rates fell to less than 20 percent. During the 1990s, the rate of RA starts at Federal Facilities has grown consistently, from less than 20 percent to more than 30 percent of all OU cleanups, which is attributed to a maturing of the federal facility program as more sites move through the pipeline.



The yearly numbers of remedy changes at PRP-lead, Fund-lead, and Federal Facilities OUs are shown in Exhibit 3-4. In the tables containing remedy change data linked to RA starts, each remedy change has been assigned to the year of the RA start for the OU to which the remedy change applies, without regard to the year in which the remedy change was adopted. For example, in Exhibit 3-2, the row for 1989 shows that 38 Fund-lead OUs had RA starts in that year. In Exhibit 3-4, the one Fund-lead ROD amendment and six Fund-lead ESDs listed in the 1989 row represent remedy changes that applied to OUs with RA starts in 1989. The ROD amendment and ESDs may have taken place in other years.

There have been a total of 26 Fund-lead and 52 PRP-lead ROD amendments at OUs with RA starts, and 62 Fund-lead and 122 PRP-lead ESDs at such OUs. This means there are about twice as many ESDs as ROD amendments in the RA start-linked data set of remedy changes, a ratio similar to that found in the entire set of remedy changes shown in Exhibit 3-1. There are also

Exhibit 3-4

Remedy Changes at OUs with RA Starts, by Lead

| Fiscal Year | ROD Amendments | | | ESDs | | |
|--------------------|-----------------------|-----------------|----------------|------------------|-----------------|----------------|
| | Fund-lead | PRP-lead | Federal | Fund-lead | PRP-lead | Federal |
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1984 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 2 | 0 | 0 | 2 | 0 | 0 |
| 1987 | 3 | 2 | 0 | 5 | 2 | 0 |
| 1988 | 2 | 7 | 0 | 9 | 3 | 0 |
| 1989 | 1 | 3 | 0 | 6 | 11 | 0 |
| 1990 | 2 | 0 | 1 | 4 | 7 | 0 |
| 1991 | 1 | 4 | 1 | 12 | 8 | 1 |
| 1992 | 3 | 9 | 0 | 6 | 16 | 6 |
| 1993 | 3 | 6 | 1 | 2 | 12 | 6 |
| 1994 | 4 | 7 | 1 | 5 | 18 | 4 |
| 1995 | 3 | 4 | 1 | 5 | 15 | 7 |
| 1996 | 1 | 3 | 2 | 1 | 15 | 2 |
| 1997 | 0 | 6 | 1 | 2 | 12 | 3 |
| 1998 | 0 | 1 | 0 | 1 | 3 | 0 |
| Total | 26 | 52 | 8 | 62 | 122 | 29 |

about twice as many PRP-lead remedy changes as Fund-lead for both kinds of remedy change. Federal Facilities have made use of remedy changes much less often than either PRP-lead or Fund-lead OUs. There have been only eight ROD amendments and 29 ESDs at federal facility OUs with RA starts in the history of the Superfund program. This means there are more than three times as many ESDs as ROD amendments at Federal Facilities with RA starts.

As Exhibit 3-5 shows, the remedy change rates (i.e., the number of remedy changes divided by the number of OUs) are similar for Fund-lead and PRP-lead OUs. The program-to-date remedy change rates for ROD amendments are 6.8 percent for Fund-lead and 8.7 percent for PRP-lead cleanups. The ESD rates are 16.1 percent for Fund-lead and 20.4 percent for PRP-lead cleanups. The remedy change rates for Federal Facilities are much lower: only 2.3 percent of Federal Facilities OUs have had ROD amendments, while 8.3 percent have had ESDs.

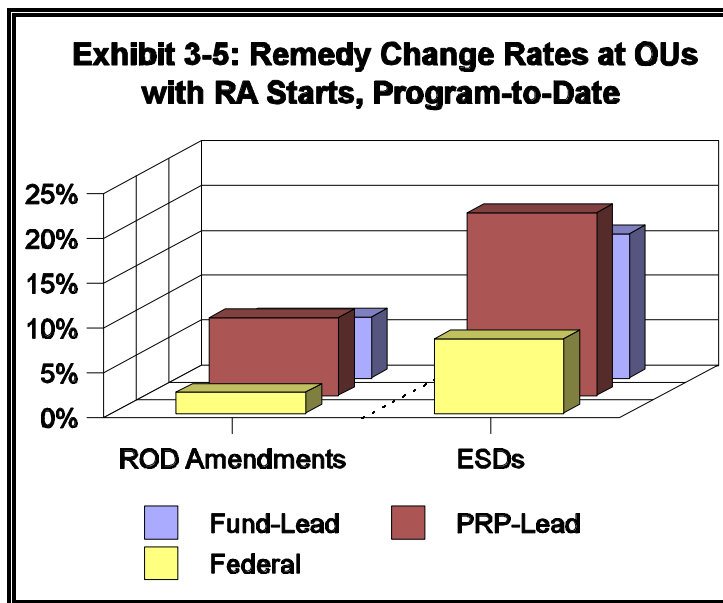
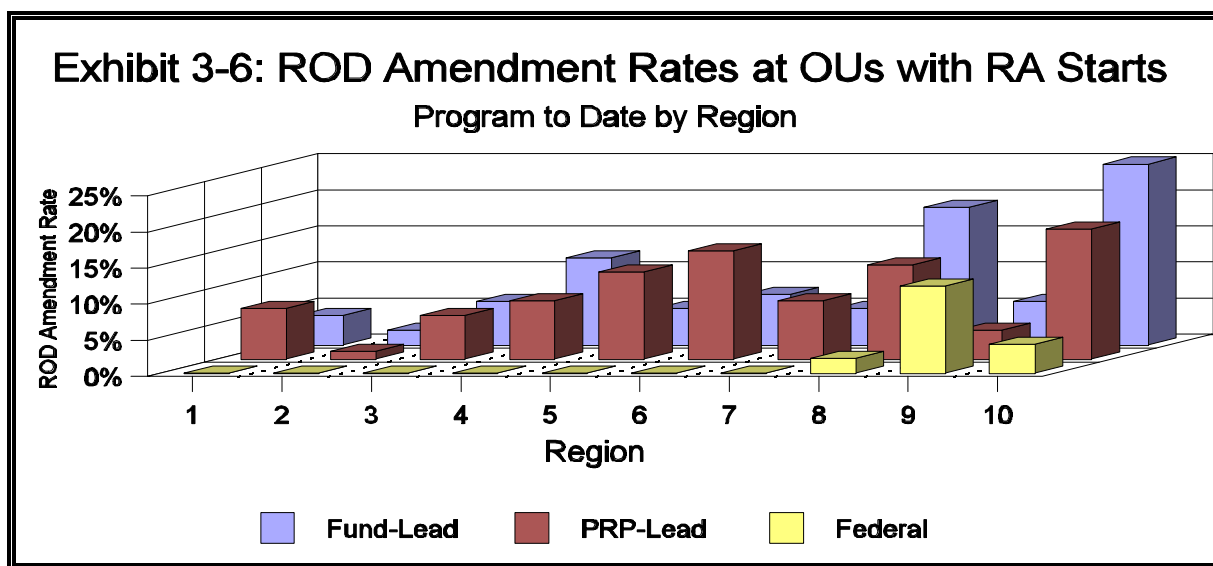


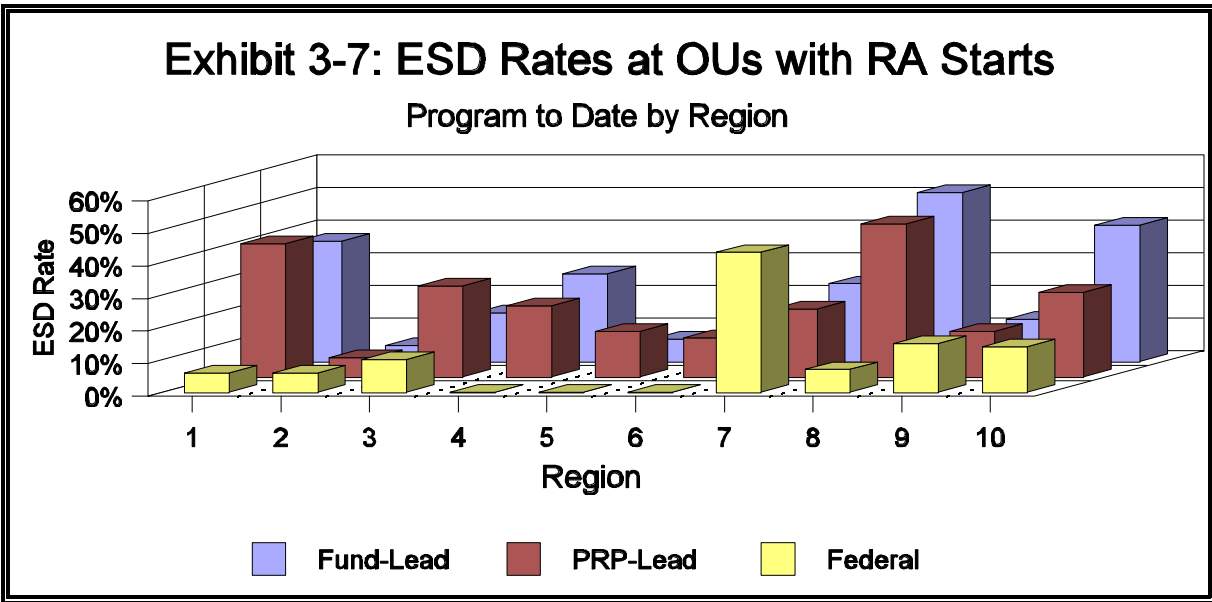
Exhibit 3-6 shows program-to-date ROD amendment rates for each EPA region. The RA start and ROD amendment data used to calculate the rates shown in this graph (and Exhibit 3-7) are presented in tables in Appendix B (Appendix B-1 presents data for Region 1, Appendix B-2 for



Region 2, etc.). When interpreting Exhibit 3-6, it is important to realize that there have been so few ROD amendments used in each individual region that one or two ROD amendments can make a large difference in the ROD amendment rate for a region. The rates of ROD amendments at Fund-lead and PRP-lead OUs are generally similar in most regions, as would be expected in light of the national data. Regions 1 through 7 have never used a ROD amendment at a Federal Facilities site. Region 8 has used one, Region 9 four, and Region 10 three.

Some regions use remedy changes more often than others (at Fund-lead and PRP-lead OUs). For example, Region 8 and Region 10 use ROD amendments at a higher rate than most regions, while Region 2 uses ROD amendments at a lower rate than most regions. Several factors could contribute to these varying rates of ROD amendment use. One possible cause is the differing mix of site types faced by various regions. For example, a region with a higher rate of complex multi-contaminant sites might have cause to reassess remedy selections more often. Differences in regional administration of the remedy selection process might also contribute to varying remedy change rates. For example, some regions might be more inclined to gather large amounts of data before selecting a remedy and issuing a ROD, resulting in lower remedy change rates, while others might rely more on the RD process for validation of the selected remedy, resulting in higher remedy change rates. Regions might also differ in where they draw the line between significant remedy changes, resulting in ESDs, and fundamental remedy changes, resulting in ROD amendments. This explanation, however, is unlikely to explain the differing rates, as the same regions tend to have higher rates for both ROD amendments and ESDs (ESD rates are shown in Exhibit 3-7).

Exhibit 3-7 shows that patterns of remedy change rates for ESDs are similar to those for ROD amendments. The regions tend to have similar rates of Fund-lead and PRP-lead ESDs. Regions 1, 8, and 10 have higher than average rates of ESD use (for both Fund-lead and PRP-lead OUs), while Regions 2 and 6 have lower than average rates. Most regions use ESDs at less than 10 percent of Federal Facilities OUs. The Federal Facilities ESD rate is higher in Regions 7, 9, and 10. However, the notable spike for Region 7 Federal Facilities ESDs is caused by only three ESDs (at a total of seven OUs). The factors contributing to differences in regional remedy change rates, which are briefly discussed in the discussion of ROD amendment rates, cannot be distinguished using the data generated by this study.



3.2 STATISTICAL ANALYSIS

Fund-lead and PRP-lead remedy changes arise from similar pools of sites remediated under similar EPA supervision. Consequently, the remedy change rates at Fund-lead and PRP-lead sites should be similar, unless there are factors that affect Fund-lead and PRP-lead OUs differently. One such potential factor is PRP influence on decisions to change remedies at sites where PRPs agree to undertake the cleanup. PRP influence could take the form of agreements in which PRPs agree to sign a consent decree and undertake a cleanup only in return for a change in the selected remedy. This is on its face a plausible scenario because EPA prefers cleanups conducted and paid for by PRPs to Fund-lead cleanups paid for by the Fund, with the prospect of cost recovery from PRPs only after further negotiations and/or litigation. Even in the absence of explicit tradeoffs in the settlement negotiation process, however, PRPs might be able to influence remedy change rates by bringing information to EPA in support of remedy changes and advocating those remedy changes. At sites where PRPs have built good working relationships with EPA personnel, such advocacy might carry significant weight. In contrast, PRPs at Fund-lead sites, who have not settled and are not directly involved in the RD/RA process, presumably have much less ability to influence remedy change decisions.⁸

⁸ PRPs conducting cleanups under UAOs arguably occupy a middle ground in terms of ability to influence remedy change decisions. They have not gained remedy change concessions in return for agreeing to settle (as they have not settled and may still contest liability by filing a CERCLA section 106(b) reimbursement petition), but they are intimately involved in the RD/RA process and could be effective advocates for remedy changes. Consequently, OUs where PRPs did work under UAOs were not included in the data set used to calculate remedy change rates.

The chi-square test of independence was used to determine if the difference in rates of PRP-lead and Fund-lead remedy changes are statistically significant. When there were subsets of data that were not large enough for use of the chi-square test, Fisher's test was used. A 95% level of significance was used for all tests. The 95% significance level for the chi-square statistic (for a 2x2 contingency table) is 3.84. Consequently, a chi-square statistic greater than 3.84 would indicate a significant difference between the remedy change rates at Fund-lead and PRP-lead OUs. Similarly, a Fisher's test probability of 0.05 or lower would indicate a significant difference between the remedy change rates at Fund-lead and PRP-lead OUs. The results of these tests are shown in Exhibit 3-8.

Exhibit 3-8: Chi-Square and Fisher Statistics Fund-Lead vs. PRP-Lead Remedy Change Rates

| Sample | ROD Amendments | | | ESDs | | |
|------------------------------------|----------------|--------|--------------|----------------|--------|--------------|
| | X ² | Fisher | Significant? | X ² | Fisher | Significant? |
| National Total, Program-to-Date | 1.153 | 0.333 | No | 2.367 | 0.132 | No |
| Region 1 | 0.384* | 1.000 | No | 0.746 | 0.806 | No |
| Region 2 | 0.229* | 1.000 | No | 0.240* | 0.738 | No |
| Region 3 | 0.001* | 1.000 | No | 2.562 | 0.159 | No |
| Region 4 | 0.434* | 0.494 | No | 0.393 | 0.624 | No |
| Region 5 | 1.913 | 0.196 | No | 1.904 | 0.226 | No |
| Region 6 | 1.325* | 0.283 | No | 1.337* | 0.397 | No |
| Region 7 | 0.188* | 1.000 | No | 0.041* | 1.000 | No |
| Region 8 | 0.305* | 0.702 | No | 0.814 | 0.415 | No |
| Region 9 | 0.141* | 1.000 | No | 0.055* | 1.000 | No |
| Region 10 | 0.247* | 0.686 | No | 0.781* | 0.483 | No |
| National Total, FY97 & F98 | 3.989* | 0.092 | No | 2.915* | 0.106 | No |

* Small sample size; chi-square test may not be valid.

No statistically significant difference was found between the Fund-lead and PRP-lead rates for either ROD amendments or ESDs. This finding of no significant difference in remedy change rates held true for national program-to-date data and for each of the ten EPA regions. In

addition, the combined national remedy change data for FY97 and FY98 was tested because the Superfund Administrative Reforms had fully taken effect by the time these remedy changes were made. Once again, the differences between Fund-lead and PRP-lead remedy change rates were not statistically significant. In summary, the remedy change rate data provides no evidence of a general pattern of increased remedy change rates at PRP-lead OUs.

The remedy change rates at Fund-lead and Federal Facilities OUs were also compared, using the same chi-square and Fisher's test procedures. In contrast to Fund-lead and PRP-lead remedy changes, which are expected to occur at similar rates, Fund-lead and Federal Facilities OUs are remediated under significantly different programs and may involve significantly different pools of sites. Consequently, no hypothesis was made as to whether the remedy change rates at Fund-lead and Federal Facilities OUs would be significantly different. The results of this analysis are shown in Exhibit 3-9.

Exhibit 3-9: Chi-Square and Fisher Statistics Fund-Lead vs. Federal Facility Remedy Change Rates

| Sample | ROD Amendments | | | ESDs | | |
|---------------------------------|----------------|--------|--------------|----------------|--------|--------------|
| | X ² | Fisher | Significant? | X ² | Fisher | Significant? |
| National Total, Program-to-Date | 8.243 | 0.004 | Yes | 10.263 | 0.002 | Yes |
| Region 1 | 1.318* | 0.435 | No | 9.079 | 0.004 | Yes |
| Region 2 | 0.417* | 1.000 | No | 0.034* | 1.000 | No |
| Region 3 | 2.643* | 0.155 | No | 0.720 | 0.559 | No |
| Region 4 | 8.091* | 0.012 | Yes | 18.65* | 0.000 | Yes |
| Region 5 | 0.987* | 1.000 | No | 1.310* | 0.567 | No |
| Region 6 | 0.224* | 1.000 | No | 0.146* | 1.000 | No |
| Region 7 | 0.346* | 1.000 | No | 0.655* | 0.643 | No |
| Region 8 | 7.495* | 0.018 | Yes | 20.33* | 0.000 | Yes |
| Region 9 | 0.405* | 1.000 | No | 0.045* | 1.000 | No |
| Region 10 | 6.731* | 0.036 | Yes | 4.699* | 0.046 | Yes |
| National Total, FY97 & F98 | 0.425* | 1.000 | No | 1.290* | 0.358 | No |

* Small sample size; chi-square test may not be valid.

The difference between national program-to-date remedy change rates for Fund-lead and Federal Facilities OUs is statistically significant for both ROD amendments and ESDs. This is not surprising in light of the difference in remedy change rates for these two categories of OU. The national program-to-date ROD amendment rate for Fund-lead OUs is 6.8 percent, compared to only 2.3 percent for Federal Facilities OUs. Similarly, the Fund-lead ESD rate of 16.1 percent is much higher than the 8.3 percent rate for Federal Facilities. For both ROD amendments and ESDs, the difference in rates was significant for Regions 4, 8, and 10, but not for any of the other seven regions. This results more from the ROD amendment and ESD rates for Fund-lead OUs in Regions 4, 8, and 10 being particularly high than from the rates at Federal Facilities being low (see Exhibits 3-6 and 3-7). However, the remedy change rates in almost every region are lower (or zero) at Federal Facilities OUs than at Fund-lead OUs. Consequently, it is likely that increased sample sizes for these regions would result in findings of significance that cannot be made with the small available samples.

3.3 REASONS FOR REMEDY CHANGES

The remedy change process is typically initiated because EPA receives information that supports a remedy change. This information may arise from EPA's own work or it may be provided by other parties, most notably PRPs. The Updating Remedy Reforms report (discussed in Section 1.3) classifies each remedy change issued in FY96 and FY97 by the party that initiated the remedy change process.⁹ The combined data for these 2 years show that a plurality of remedy changes (46 percent) were initiated by PRPs, typically at sites where they have undertaken the RD/RA process.

The Updating Remedy Changes report also notes that remedy changes tend to occur during the remedial design stage of the Superfund process, and that most remedy changes do at least one of the following things: (1) change the scope of the remedy (e.g., by increasing or decreasing the volume of soil or groundwater treated); (2) modify the performance of the remedy (e.g., by replacing an innovative remediation technique that has proven inefficient with a proven technique); or (3) reduce the cost of the remedy (e.g., by using off-site disposal of contaminated soil instead of on-site incineration). The data summaries created for remedy changes in this study generally support this conclusion. Appendix C to this report contains a representative selection of remedy change summaries showing the kinds of remedy changes that are made and the level of community involvement in the remedy change process. Each summary describes the original remedy, the nature of the remedy change, the reasons for the remedy change, and the level of community involvement.

⁹ In this study, the only source of data about which party initiated a remedy change was the remedy change text. Because remedy change texts often fail to clearly identify the party that initiated a remedy change, that data has not been summarized.

3.4 COMMUNITY PARTICIPATION IN THE REMEDY CHANGE PROCESS

Both the remedy change data summaries created as part of this study and the Updating Remedies Reform report (discussed in Section 1.3) document that the regions regularly provide the public with the opportunity to participate in the remedy change process as required by CERCLA, the NCP, and EPA guidance (as discussed in Section 1.2). EPA takes public opinion into account in selecting remedy changes, and in several instances has changed remedies in light of public opposition to an element of the remedy (e.g., by choosing alternatives to on-site incineration).

ESDs must be made locally available to the public as part of the record for the site, and notice of that availability must be given by publication in a local newspaper of general circulation. Many notices of ESD availability do not draw public comment. Further opportunities for public involvement, such as a public meeting or a comment period, are usually optional. A significant exception, however, applies to ESDs arising out of RD/RA negotiations. When a consent decree includes significant changes to the selected remedy, the ESD is issued for public comment along with the consent decree and the public has opportunity not only to comment on the ESD, but also to oppose the ESD by opposing entry of the consent decree. This is an important factor in evaluating the concern that EPA and PRPs might trade inappropriate remedy changes for a commitment to undertake RD/RA, as the requirement of a formal public comment period reduces the probability that a remedy change can be privately negotiated and slipped by the public without notice.

EPA sometimes provides opportunity for public participation beyond that which is required, especially where there is a high level of public interest in a Superfund site. For example, before issuing an ESD at the PRP-lead Reich Farm NPL site in May 1998, Region 2 held a public meeting to discuss the addition of an activated carbon treatment system to two municipal public water supply wells. This ESD was the result of an intensive study of the Dover, NJ, water supply in response to an apparent elevated rate of childhood cancers in Dover. Low levels of previously undetected contaminants were identified, and the ESD provided additional treatment to address those contaminants. Most of the people who spoke at the public meeting supported the ESD, and the meeting also served as a forum for dissemination of information about the treatment program.

Public opinion is also a factor in EPA's decision whether to propose an ESD. At the PRP-lead Whitmoyer Laboratories NPL site, Region 3 adopted an ESD that substituted off-site incineration and on-site fixation followed by off-site disposal for the original remedy of on-site incineration. This remedy change was made in part because of public opposition at an earlier public meeting to on-site incineration near several homes and one-half mile from an elementary school. The public strongly supported the remedy change at a public meeting addressing the proposed ESD.

Public participation requirements for a ROD amendment are much more extensive than those for an ESD, including notice of availability of the revised proposed plan, a public comment period, the opportunity for a public meeting, and a responsiveness summary addressing issues raised in public comments. Although ROD amendments are more likely than ESDs to draw public

comment, a survey of ROD amendment data summaries shows that public interest is often limited. When there is public interest, regions may initiate ROD amendments to accommodate public concerns as well as the concerns of PRPs. For example, Region 10 used a ROD amendment at the PRP-lead Wyckoff/Eagle Harbor NPL site (West Harbor OU) to change the remedy from excavation of nearshore mercury hotspots to containment of the hotspots in a nearshore confined disposal facility. This change was not driven by technical or environmental remediation issues, but rather served primarily to create about an acre of fill onto which a state ferry maintenance facility could expand its operations. Creation of the fill allowed the preservation of a private boat repair facility located on land that would otherwise have been used in the ferry facility expansion. This remedy, which resolved a local land use dispute, received strong local support in over 30 comments submitted during the comment period.

EPA has implemented several Superfund Administrative Reforms designed to supplement the statutorily guaranteed opportunity to participate in the remedy selection process by facilitating informed and effective actual participation in that process. These include the Community Involvement in the Enforcement Process reform and reforms designed to encourage use of community advisory groups and technical assistance grants (TAGs), as described in Section 1.1. These reforms are all potentially applicable to the remedy change process as well as the process of selecting the original ROD, and may have contributed to the general level of community participation at sites where remedy changes have been used. Two remedy change texts for ROD amendments completed before initiation of the Superfund Administrative Reforms did note that TAGs had been granted at the sites.¹⁰ However, the remedy change texts reviewed as part of this study have not explicitly identified the contribution of these reforms to public participation in the remedy change process. Even absent specific examples of their effectiveness, however, these reforms do demonstrate EPA's commitment to openness and public participation in the Superfund process.

¹⁰ The sites were Crystal Chemical Co. and Tenth Street Dump/Junkyard, both in Region 6.

4.0 SUMMARY

The Superfund program has adopted a total of 132 ROD amendments and 288 ESDs. The use of remedy changes has grown from less than ten per year during the 1980s to an average of more than 40 per year during the 1990s. The growth in use of remedy changes in the 1990s roughly parallels the growth in the number of Superfund sites that have progressed through the Superfund “pipeline” and reached the RD/RA stage during this decade. During FY97, EPA adopted 59 ESDs and 25 ROD Amendments, the most ever for a single year. The Updating Remedy Decisions reform, which went into effect in FY96, has probably contributed to recent growth in the number of remedy changes.

Of all OUs with RA starts program-to-date, 52 percent have been PRP-lead, 25 percent Fund-lead, and 23 percent Federal Facilities. In the first few years of the Superfund program, the few RA starts that occurred were predominantly Fund-lead. As the Superfund program entered the 1990s, PRP-lead cleanup rates climbed to more than 50 percent under the “enforcement first” policy, while the Fund-lead cleanup rate fell to less than 20 percent. During the 1990s, the rate of RA starts at Federal Facilities has grown consistently, from less than 20 percent to more than 30 percent of all OU cleanups.

Remedy change rates for Fund-lead and PRP-lead OUs are similar. The program-to-date remedy change rates for ROD amendments are 6.8 percent for Fund-lead and 8.7 percent for PRP-lead cleanups. The ESD rates of 16.1 percent for Fund-lead and 20.4 percent for PRP-lead cleanups are similarly close. The remedy change rates for Federal Facilities, however, are much lower: only 2.3 percent of Federal Facilities OUs have had ROD amendments, while 8.3 percent have had ESDs.

The study found that the differences in remedy change rates at Fund-lead and PRP-lead OUs are not statistically significant. This finding holds true for national program-to-date data and for each of the ten EPA regions for both ROD amendments and ESDs. Consequently, the remedy change data provides no evidence of a general pattern of increased remedy change rates at PRP-lead OUs. If there were a pattern of EPA agreeing to inappropriate remedy changes at PRP-lead sites, one would expect the remedy change rates at PRP-lead OUs to be higher than the rates at Fund-lead OUs, where the PRP influence is not present. The difference between national program-to-date remedy change rates for Fund-lead and Federal Facilities OUs is statistically significant for both ROD amendments and ESDs.

Both the remedy change data summaries created as part of this study and the Updating Remedies Reform report document that the regions regularly provide the public with the opportunity to participate in the remedy change process as required by CERCLA, the NCP, and EPA guidance. Although public interest and actual participation in the remedy change process are typically limited, especially for ESDs, the data summaries did contain examples of EPA, in response to public interest, providing the public with greater opportunities for participation in the remedy change process than is required.

Appendix A-1: ROD Amendments, Program-to-Date

| Fiscal Year | Region 1 | Region 2 | Region 3 | Region 4 | Region 5 | Region 6 | Region 7 | Region 8 | Region 9 | Region 10 | National |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|-----------------|
| 1983 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| 1987 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 4 |
| 1988 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 3 |
| 1989 | 1 | 0 | 0 | 2 | 3 | 0 | 0 | 1 | 0 | 0 | 7 |
| 1990 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 4 |
| 1991 | 0 | 0 | 1 | 1 | 5 | 0 | 1 | 2 | 1 | 1 | 12 |
| 1992 | 0 | 0 | 1 | 1 | 4 | 3 | 0 | 1 | 0 | 1 | 11 |
| 1993 | 1 | 0 | 1 | 1 | 0 | 1 | 3 | 3 | 1 | 0 | 11 |
| 1994 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 4 |
| 1995 | 0 | 2 | 0 | 3 | 5 | 2 | 1 | 2 | 4 | 0 | 19 |
| 1996 | 1 | 0 | 4 | 3 | 4 | 1 | 1 | 0 | 2 | 3 | 19 |
| 1997 | 1 | 3 | 2 | 6 | 5 | 3 | 0 | 0 | 0 | 5 | 25 |
| 1998 | 0 | 0 | 0 | 1 | 3 | 1 | 0 | 0 | 1 | 1 | 7 |
| Totals | 5 | 5 | 11 | 22 | 33 | 11 | 6 | 13 | 11 | 15 | 132 |

Appendix A-2: Explanations of Significant Differences, Program-to-Date

| Fiscal Year | Region 1 | Region 2 | Region 3 | Region 4 | Region 5 | Region 6 | Region 7 | Region 8 | Region 9 | Region 10 | National |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|-----------------|
| 1988 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1989 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 5 |
| 1990 | 4 | 0 | 6 | 0 | 0 | 1 | 1 | 2 | 0 | 1 | 15 |
| 1991 | 3 | 1 | 4 | 1 | 2 | 0 | 2 | 2 | 2 | 0 | 17 |
| 1992 | 4 | 0 | 6 | 0 | 1 | 0 | 3 | 6 | 0 | 4 | 24 |
| 1993 | 4 | 2 | 4 | 6 | 5 | 0 | 0 | 7 | 1 | 3 | 32 |
| 1994 | 4 | 0 | 6 | 4 | 3 | 0 | 2 | 5 | 2 | 8 | 34 |
| 1995 | 2 | 3 | 8 | 2 | 6 | 2 | 4 | 7 | 1 | 6 | 41 |
| 1996 | 5 | 0 | 11 | 9 | 4 | 3 | 6 | 5 | 3 | 4 | 50 |
| 1997 | 7 | 8 | 10 | 5 | 12 | 2 | 1 | 3 | 8 | 3 | 59 |
| 1998 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 2 | 1 | 1 | 10 |
| Totals | 35 | 15 | 56 | 30 | 34 | 9 | 20 | 41 | 18 | 30 | 288 |

Appendix B-1: Remedy Changes at Operable Units with RA Starts Region 1

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------------|----------------------------|-----------------------|-----------------------|---------------------------|----------------------|----------------------|--------------------------|---------------------|---------------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 |
| 1988 | 2 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 |
| 1989 | 2 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 |
| 1990 | 3 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 2 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 |
| 1992 | 3 | 0 | 2 | 5 | 0 | 1 | 0 | 0 | 0 |
| 1993 | 2 | 0 | 0 | 5 | 0 | 2 | 2 | 0 | 0 |
| 1994 | 1 | 0 | 0 | 5 | 2 | 3 | 4 | 0 | 0 |
| 1995 | 2 | 0 | 0 | 5 | 0 | 4 | 10 | 0 | 2 |
| 1996 | 1 | 0 | 0 | 5 | 0 | 3 | 6 | 0 | 0 |
| 1997 | 2 | 0 | 1 | 3 | 0 | 1 | 11 | 0 | 0 |
| 1998 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Total | 27 | 1 | 10 | 41 | 3 | 17 | 35 | 0 | 2 |

Appendix B-2: Remedy Changes at Operable Units with RA Starts Region 2

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------|---------------------|----------------|----------------|--------------------|---------------|---------------|-------------------|--------------|--------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 4 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 9 | 1 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 7 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| 1990 | 8 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 11 | 0 | 1 | 6 | 0 | 0 | 4 | 0 | 0 |
| 1992 | 3 | 1 | 0 | 7 | 0 | 0 | 5 | 0 | 0 |
| 1993 | 10 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 8 | 0 | 0 | 11 | 0 | 2 | 4 | 0 | 0 |
| 1995 | 3 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 6 | 0 | 0 | 9 | 0 | 0 | 1 | 0 | 1 |
| 1997 | 8 | 0 | 0 | 10 | 1 | 2 | 4 | 0 | 0 |
| 1998 | 1 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 |
| Total | 88 | 2 | 4 | 78 | 1 | 5 | 18 | 0 | 1 |

Appendix B-3: Remedy Changes at Operable Units with RA Starts Region 3

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------------|----------------------------|-----------------------|-----------------------|---------------------------|----------------------|----------------------|--------------------------|---------------------|---------------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 8 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 5 | 0 | 1 | 5 | 3 | 2 | 1 | 0 | 0 |
| 1989 | 8 | 0 | 1 | 8 | 0 | 3 | 0 | 0 | 0 |
| 1990 | 6 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 8 | 0 | 2 | 6 | 0 | 1 | 1 | 0 | 1 |
| 1992 | 5 | 0 | 1 | 6 | 0 | 0 | 3 | 0 | 0 |
| 1993 | 7 | 0 | 0 | 11 | 0 | 3 | 2 | 0 | 1 |
| 1994 | 4 | 1 | 2 | 9 | 0 | 6 | 3 | 0 | 1 |
| 1995 | 1 | 0 | 0 | 10 | 0 | 3 | 7 | 0 | 1 |
| 1996 | 4 | 1 | 0 | 5 | 0 | 1 | 4 | 0 | 0 |
| 1997 | 3 | 0 | 0 | 5 | 1 | 1 | 11 | 0 | 0 |
| 1998 | 1 | 0 | 0 | 6 | 1 | 2 | 10 | 0 | 0 |
| Total | 66 | 4 | 10 | 79 | 5 | 22 | 42 | 0 | 4 |

Appendix B-4: Remedy Changes at Operable Units with RA Starts Region 4

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------------|----------------------------|-----------------------|-----------------------|---------------------------|----------------------|----------------------|--------------------------|---------------------|---------------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 5 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| 1988 | 6 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 4 | 0 | 1 | 9 | 1 | 2 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 7 | 0 | 0 | 7 | 0 | 0 |
| 1993 | 2 | 1 | 2 | 14 | 1 | 3 | 7 | 0 | 0 |
| 1994 | 4 | 1 | 1 | 7 | 1 | 3 | 9 | 0 | 0 |
| 1995 | 0 | 0 | 0 | 7 | 0 | 2 | 12 | 0 | 0 |
| 1996 | 3 | 0 | 0 | 11 | 1 | 3 | 13 | 0 | 0 |
| 1997 | 4 | 0 | 0 | 5 | 1 | 2 | 6 | 0 | 0 |
| 1998 | 0 | 0 | 0 | 2 | 0 | 0 | 10 | 0 | 0 |
| Total | 33 | 4 | 9 | 74 | 6 | 16 | 64 | 0 | 0 |

Appendix B-5: Remedy Changes at Operable Units with RA Starts Region 5

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------|---------------------|----------------|----------------|--------------------|---------------|---------------|-------------------|--------------|--------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 7 | 1 | 0 | 14 | 0 | 0 | 1 | 0 | 0 |
| 1988 | 5 | 0 | 0 | 6 | 1 | 1 | 1 | 0 | 0 |
| 1989 | 4 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 0 |
| 1990 | 2 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 0 |
| 1991 | 12 | 0 | 3 | 9 | 2 | 1 | 1 | 0 | 0 |
| 1992 | 5 | 1 | 0 | 11 | 5 | 4 | 1 | 0 | 0 |
| 1993 | 3 | 0 | 0 | 13 | 4 | 2 | 3 | 0 | 0 |
| 1994 | 3 | 0 | 0 | 22 | 2 | 0 | 0 | 0 | 0 |
| 1995 | 2 | 1 | 0 | 15 | 2 | 3 | 3 | 0 | 0 |
| 1996 | 5 | 0 | 1 | 11 | 0 | 6 | 6 | 0 | 0 |
| 1997 | 4 | 0 | 0 | 8 | 0 | 2 | 0 | 0 | 0 |
| 1998 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| Total | 57 | 3 | 4 | 135 | 16 | 19 | 18 | 0 | 0 |

Appendix B-6: Remedy Changes at Operable Units with RA Starts Region 6

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------------|----------------------------|-----------------------|-----------------------|---------------------------|----------------------|----------------------|--------------------------|---------------------|---------------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 6 | 0 | 0 | 6 | 1 | 0 | 1 | 0 | 0 |
| 1990 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 4 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 1992 | 2 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 0 |
| 1993 | 6 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 3 | 1 | 0 | 6 | 0 | 1 | 0 | 0 | 0 |
| 1995 | 3 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 |
| 1996 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 4 | 0 | 1 | 3 | 1 | 1 | 1 | 0 | 0 |
| 1998 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| Total | 43 | 3 | 2 | 33 | 5 | 4 | 3 | 0 | 0 |

Appendix B-7: Remedy Changes at Operable Units with RA Starts Region 7

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------|---------------------|----------------|----------------|--------------------|---------------|---------------|-------------------|--------------|--------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 2 | 0 | 1 | 5 | 0 | 2 | 1 | 0 | 0 |
| 1992 | 1 | 0 | 0 | 7 | 0 | 2 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 0 | 2 | 5 | 0 | 1 | 1 | 0 | 0 |
| 1995 | 1 | 0 | 0 | 5 | 1 | 2 | 2 | 0 | 2 |
| 1996 | 2 | 0 | 0 | 5 | 2 | 0 | 1 | 0 | 0 |
| 1997 | 3 | 0 | 0 | 3 | 0 | 1 | 2 | 0 | 1 |
| 1998 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 21 | 1 | 5 | 39 | 3 | 8 | 7 | 0 | 3 |

Appendix B-8: Remedy Changes at Operable Units with RA Starts Region 8

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------------|----------------------------|-----------------------|-----------------------|---------------------------|----------------------|----------------------|--------------------------|---------------------|---------------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1988 | 2 | 0 | 2 | 2 | 2 | 0 | 5 | 0 | 0 |
| 1989 | 5 | 1 | 3 | 3 | 0 | 1 | 1 | 0 | 0 |
| 1990 | 1 | 0 | 1 | 2 | 0 | 7 | 5 | 0 | 0 |
| 1991 | 1 | 0 | 1 | 3 | 1 | 1 | 10 | 1 | 0 |
| 1992 | 2 | 0 | 1 | 1 | 0 | 1 | 8 | 0 | 3 |
| 1993 | 0 | 0 | 0 | 5 | 1 | 2 | 3 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 6 | 0 | 1 | 3 | 0 | 1 |
| 1995 | 7 | 1 | 3 | 2 | 0 | 0 | 5 | 0 | 0 |
| 1996 | 1 | 0 | 0 | 2 | 0 | 1 | 9 | 0 | 0 |
| 1997 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| 1998 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Total | 21 | 4 | 11 | 30 | 4 | 14 | 56 | 1 | 4 |

Appendix B-9: Remedy Changes at Operable Units with RA Starts Region 9

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------|---------------------|----------------|----------------|--------------------|---------------|---------------|-------------------|--------------|--------------|
| 1981 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 9 | 0 | 0 | 1 | 1 | 0 |
| 1991 | 0 | 0 | 0 | 15 | 0 | 1 | 0 | 0 | 0 |
| 1992 | 2 | 0 | 2 | 3 | 1 | 2 | 2 | 0 | 3 |
| 1993 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 1 | 0 |
| 1994 | 0 | 0 | 0 | 7 | 1 | 0 | 6 | 1 | 0 |
| 1995 | 1 | 0 | 0 | 6 | 0 | 1 | 7 | 0 | 0 |
| 1996 | 4 | 0 | 0 | 2 | 0 | 1 | 5 | 1 | 0 |
| 1997 | 0 | 0 | 0 | 3 | 0 | 0 | 7 | 0 | 2 |
| 1998 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 |
| Total | 16 | 1 | 2 | 50 | 2 | 7 | 33 | 4 | 5 |

Appendix B-10: Remedy Changes at Operable Units with RA Starts Region 10

| Fiscal Year | Fund-lead RA Starts | Fund-lead AMDs | Fund-lead ESDs | PRP-lead RA Starts | PRP-lead AMDs | PRP-lead ESDs | Federal RA Starts | Federal AMDs | Federal ESDs |
|--------------------|----------------------------|-----------------------|-----------------------|---------------------------|----------------------|----------------------|--------------------------|---------------------|---------------------|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 0 | 0 | 0 | 5 | 1 | 2 | 0 | 0 | 0 |
| 1990 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 0 | 0 | 0 | 10 | 2 | 4 | 1 | 0 | 0 |
| 1993 | 0 | 0 | 0 | 3 | 0 | 0 | 10 | 0 | 5 |
| 1994 | 1 | 0 | 0 | 4 | 1 | 1 | 12 | 0 | 2 |
| 1995 | 3 | 1 | 2 | 2 | 0 | 0 | 8 | 1 | 2 |
| 1996 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 1 | 1 |
| 1997 | 1 | 0 | 0 | 5 | 2 | 2 | 9 | 1 | 0 |
| 1998 | 1 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 |
| Total | 12 | 3 | 5 | 38 | 7 | 10 | 72 | 3 | 10 |

Appendix C: Selected Remedy Change Data Summaries

| Site Name (Type/Region) Date | Remedy Selected in Original ROD | Nature of Remedy Change | Reason for Remedy Change | Community Involvement in Remedy Change Process |
|---|--|--|--|--|
| Keefe Environmental Services (PRP ESD/Reg. 1) 06/08/90 | <u>In situ</u> treatment of contaminated soil using vacuum extraction technology and pumping and treating contaminated ground water using air stripping, filtration, and carbon adsorption. | Vacuum extraction technology will not be used on soil, the pump and treat system will be extended to capture contamination further off site, and contaminants trapped in extremely dense soil will be monitored but not removed. | Pre-remedial design activities revealed changes in the extent of contamination determined by the remedial investigation. Cleanup standards had already been met in site soil, while contaminated ground water had migrated west of the site into a sand and gravel aquifer beneath a wetland and into deep till soil. Remediation of the latter was not considered necessary as this area is poorly connected with the upper till aquifer and would not provide enough water for a well in any case. | An informational meeting was held on June 26, 1990, and the ESD provides the address where it and the rest of the administrative record can be reviewed. |
| Hocomonco Pond (PRP ESD/Reg. 1) 07/22/92 | Dewatering pond and lowering ground water level to expose contaminated material; "dry" soil and waste excavation, dewatering, and on-site disposal. Placement of sheet piling to ensure stability of adjacent street. | "Wet" excavation of shallow contaminated material; use of <u>in situ</u> bioremediation, soil flushing, and product recovery on deeper contaminants. | Pre-design investigations showed transmissivity of the aquifer was greater than estimated in the RI; contaminants extended down 140 feet. Large boulders prevented installation of sheet piling to the required depth. Lowering ground water would therefore cause the adjacent street to collapse. | A public information meeting was held on May 11, 1992, and the ESD provides addresses of places where it and the rest of the administrative record can be reviewed. |
| Iron Horse Park (PRP ESD/Reg. 1) 10/01/97 | Treatment of contaminated soil and sludge from lagoons by bioremediation, returning the treated material to the lagoon area, covering it with clean soil, and establishing a vegetative cover; and decontamination and disposal of piping and pumps associated with the lagoons. | Excavation and off-site treatment of contaminated materials by asphalt batching at a soil recycling facility. | In further tests at the site, bioremediation was unable to achieve cleanup levels in a timely manner, and asphalt batching has proved to be more time and cost efficient. | Documents pertaining to this site were placed in both the local and site repositories for public review, a thirty day public comment period was given, and a public meeting was held at the Billerica Town Hall to provide information and answer questions regarding this matter. |

| Site Name (Type/Region) Date | Remedy Selected in Original ROD | Nature of Remedy Change | Reason for Remedy Change | Community Involvement in Remedy Change Process |
|--|---|---|---|--|
| Delaware City PVC Plant (PRP ESD/Reg. 3) 09/18/91 | Collecting ground water with recovery wells at the northern and southern edges of the plume, reusing it in a PRP's manufacturing plant or remediating it in PRP's wastewater treatment plant during periods of low demand at the manufacturing plant; excavating and removing polyvinyl chloride sludge and contaminated soil from pits, lagoons and a stormwater reservoir, and furnishing these areas with double synthetic liners. | Installation of an air stripper to treat ground water instead of using it in the PRP's manufacturing plant; replacing pits and stormwater reservoir with an aboveground storage tank. | PRP was concerned that the groundwater quality might affect its manufacturing process. PRP's internal environmental policies stated a preference for above-ground tanks vs. impoundments. EPA said the changes would "increase the protectiveness and efficiency of the remedial action." | Notice of ESD was published in local newspapers and the public was afforded 15-day comment period. |
| EH Schilling Landfill (PRP ESD/Reg. 5) 02/28/92 | Treat leachate and liquid waste from landfill using metal precipitation (Sulfide), air stripping, and carbon adsorption; RCRA Subtitle C compliant cap; installation of cutoff wall around landfill; stabilize dam fence; treatment of GW; long-term maintenance; and quarterly GW monitoring. | Change air stripping component to biological reactors; and change metal precipitation from sulfide to sodium hydroxide. | Treatability study and new information gathered during RD indicated that phenol and acetone at the newly discovered levels would not be treated by air stripping. Therefore, a change to biological reactors would be needed to meet the NPDES numbers. Also, sodium hydroxide was more effective than sulfide. | PRP's proposed change and Agency agreed. Community was not interested in the change. |
| Springfield Township Dump (PRP ESD/Reg. 5) 11/18/93 | Excavation and treatment of VOC and other organic-contaminated soil onsite by incineration followed by solidifying of residual ash; treatment of metal-contaminated soil using solidification and redepositing treated soil onsite; treating remaining contaminated soils and ash onsite; groundwater pump and treatment using carbon adsorption followed by onsite reinjection of treated water; and implementation of institutional controls. | Groundwater cleanup levels were published. | No levels were quantified in the ROD. | Publication of the cleanup levels was requested by the public. Round table discussions were held with EPA, PRPs, citizens, and a local action group. |

| Site Name (Type/Region) Date | Remedy Selected in Original ROD | Nature of Remedy Change | Reason for Remedy Change | Community Involvement in Remedy Change Process |
|---|---|---|--|---|
| Chemplex Co. (PRP ESD/Reg. 7) 07/26/91 | Groundwater pump and treatment at existing onsite biological activated sludge wastewater treatment plant with discharge to SW; and implementation of groundwater use and deed restrictions. | Goal for groundwater pump and treat for a portion of site was changed from restoration to containment; a contingent technical impracticability waiver was added. | Discovery of DNAPLs at site. | ESD was available for public comment for 30 days at the same time as the consent decree was available for public comment. |
| Burlington Northern (Somers Plant) (PRP ESD/Reg. 8) 06/26/92 | Bioremediation of soils. Hot water flushing of soils near lake. Groundwater pump and treat with in-situ bioremediation. | Hot water flushing was determined to be ineffective. Additional soil was excavated for surface land treatment. | Bench scale testing of the hot water flushing indicated lower contaminant recoveries than envisioned in ROD. EPA required a change in excavated soil volumes to include all of area to be flushed. | A public meeting was held to discuss the ESD. A fact sheet about the ESD, including document locations and contact persons, was sent to the site mailing list. |
| Minot Landfill (PRP ESD/Reg. 8) 04/10/96 | Installation of a 3 foot cap to prevent direct contact by receptors with the waste or leachate; installation of an active gas extraction system; sampling of groundwater at regular intervals to demonstrate that the selected remedy is effective; and implementation of institutional controls to prohibit any human activity on the landfill that would expose receptors to refuse or leachate, or that would damage the containment system. | Installation of a passive gravity drain system; construction of passive gas vents; and clarification of cap design: 18 inches of clay, 12 inches of root zone material, and 6 inches of topsoil. | The revised remedy will be easier to install, have lower capital costs, be easier to operate and maintain, as there is no mechanical and electrical equipment such as leachate pumps and gas blowers, have lower operation and maintenance costs, have a more simple design which makes it easier to modify the design during construction, and have a shorter time frame for construction. The cost savings will \$325,000. | Documents pertaining to the site were placed in both the local and site repositories for public review. Limited community involvement took place through monthly city council meetings. |
| Purity Oil Sales, Inc. (PRP ESD/Reg. 9) 07/03/96 | The site will be covered with a cap that satisfies RCRA Subtitle C requirements; a layered cap with gas and liquid drainage collection systems will be constructed; soil vapor extraction wells will be installed; a slurry wall 25 feet deep will be constructed along the site; canal lining will be installed; and post closure monitoring will be done. | Modify the edges of the RCRA-equivalent closure cover to eliminate the need for a retaining wall; extend the cover to the rear of the Golden State Market; monitor gas collected from beneath the closure cover (but there will be no treatment); and decrease the number of vapor extraction wells from 58 to 4. | The RI/FS did not include field studies. After the Pre-final (90%) Design report was completed, it was determined, based upon field soil permeability measurements, that only 4 vapor extraction wells were needed. | EPA conducted a community meeting to discuss the ESD with local residents. In addition, documents pertaining to this site were placed in the local repository for public review. |

| Site Name (Type/Region) Date | Remedy Selected in Original ROD | Nature of Remedy Change | Reason for Remedy Change | Community Involvement in Remedy Change Process |
|--|--|---|---|---|
| Pinette's Salvage Yard (Fund ESD/Reg. 1) 06/26/96 | Cleanup was to be done in two primary components: Source Control and Management of Migration. This ESD only affects the Management of Migration component, which included extraction of contaminated groundwater containing concentrations above the target cleanup goals; treatment on site using filtration and carbon adsorption; and a site target cleanup goal for lead of 5 ppb. | Adjustment of the site target cleanup goal for lead to the current nationally accepted MCL of 15 ppb; additional extraction and treatment of groundwater in order to reach the original cleanup target of 5 ppb not warranted | The target cleanup goal for lead was based on a proposed maximum contaminate level for drinking water which was never adopted; and groundwater sampling data collected during the Management of Migration Pre-design studies following the completion of the source control remedy indicate that the concentrations of VOCs have decreased to below or near the target cleanup goals established in the 1989 ROD. | Documents pertaining to this site were placed in both the local and site repositories for public review. |
| Davis Liquid Waste (Fund ESD/Reg. 1) 07/19/96 | Excavation and on-site incineration of contaminated soils and wastes; on-site groundwater extraction and treatment system; and an alternative water supply for residents affected or potentially affected by groundwater contamination from the site. | Treatment of contaminated soils and wastes using on-site thermal desorption instead of on-site incineration. | At the time of the original ROD there was a limited amount of performance data available for the thermal desorption technology. Since the ROD, thermal desorption has proven very effective in treating contaminated soils and wastes. | Documents pertaining to the site were placed in both local and site repositories for public review. A 30-day public comment period was held in which EPA received two sets of comments. At the request of one individual, the comment period was extended for an additional 23 days. Both sets of comments were supportive of changing the method of on-site treatment, but expressed a preference for soil vapor extraction over thermal desorption. |

| Site Name (Type/Region) Date | Remedy Selected in Original ROD | Nature of Remedy Change | Reason for Remedy Change | Community Involvement in Remedy Change Process |
|--|--|---|---|---|
| De Rewal Chemical Co. (Fund ESD/Reg. 2) 06/12/97 | Excavation of soil contaminated with organic and inorganic compounds above action levels; on-site thermal treatment of the organic-contaminated soil; on-site solidification/stabilization of the thermally treated soil and the remaining inorganic-contaminated soil; extraction of shallow ground water contaminated above drinking water standards, on-site storage, and off-site disposal at an approved industrial wastewater treatment facility; provision of a treatment system for an on-site residential well; environmental monitoring to ensure the effectiveness of the remedy; and establishment of deed restrictions, as necessary. | Excavated inorganic-contaminated soil will be transported off-site for disposal as opposed to on-site solidification/stabilization and disposal as described in the original ROD. | Treatability tests during the Remedial Design indicated that the inorganic contaminated soils located above the water table represent a continuing source of contamination to the ground water. | The availability of the ESD was announced in the local newspaper and documents pertaining to the site were placed in a site repository. |
| Greenwood Chemical Co. (Fund ESD/Reg. 3) 03/24/94 | Excavation of contaminated soil followed by offsite incineration and disposal and backfilling the excavated areas with clean soil; removal of chemicals stored in onsite buildings; and SW collection/diversion during remedy implementation. | Remediation of additional contaminated soils identified onsite. Increase volume of soil to be excavated/treated from 4,500 cy to 11,000 cy. | Based upon RI findings and additional study during RD, it was determined that additional contaminated soils were present onsite which required remediation. | Draft ESD issued for public comment. Final ESD issued with responsiveness summary. ESD placed in Administrative Record for site. |
| Lackawanna Refuse (Fund ESD/Reg. 3) 09/28/93 | Excavation and offsite disposal of drums and highly contaminated fill; leachate collection and surface drainage diversion; clay capping and construction of gas venting systems; and reconstruction of access road. Leachate treatment. | Elimination of leachate treatment. | Cap over the landfill has dramatically reduced amount of leachate. There are no leachate seeps. Leachate treatment was found to be unnecessary. | Meeting with local citizen group and announcement in newspaper. |

| Site Name (Type/Region) Date | Remedy Selected in Original ROD | Nature of Remedy Change | Reason for Remedy Change | Community Involvement in Remedy Change Process |
|---|---|---|---|---|
| Aidex Corporation (Fund ESD/Reg. 7) 09/10/91 | Excavation and offsite disposal of buried wastes and contaminated soil; backfilling, grading, and seeding of the site; expansion of the monitoring well network and biannual GW testing; and vacuuming and washing interior surfaces, floors, and walls of the onsite building. | The ROD postponed a decision re: cleanup of GW pending further analysis/monitoring. Several years of GW monitoring indicated that GW treatment was unnecessary. Decision made to continue periodic monitoring until the remaining containment of concern is below MCL (atrazine). | The ESD was issued to address GW component of remedy, which had not been previously addressed in ROD. | The ESD was issued for public comment on 7/22/91-8/21/91. |
| Hipps Road Landfill (PRP AMD/R. 4) 09/21/90 | Closing landfill, ground water pumping followed by off-site discharge to a POTW for treatment, and institutional controls. | On-site ground water treatment using air stripping followed by on-site discharge of treated water to a storm water retention basin, and monitoring of on-site and off-site ground water. | Ground water investigations after 1986 revealed that contamination was not as extensive in area or degree as previously estimated. Remedy change will substantially reduce the overall cost of remediation. | EPA published fact sheets in September 1988 and June 1990; and held public meetings on April 5, 1989, August 15, 1989, and July 11, 1990. EPA extended the 30-day public comment period for 30 days at local citizens' request. |
| Helena Chemical Co. Landfill (PRP AMD/Reg. 4) 09/01/95 | Extraction of contaminated ground water; treatment of contaminated ground water by means of carbon absorption; discharge of treated ground water to the local POTW; excavation and treatment by means of a combination of hydrolysis/proteolytic dechlorination (HPD) and biological treatments of waste materials and contaminated soils; and mitigation of the biological effects of contaminated sediments by the restoration or creation of a suitable wetland habitat. | Incineration of waste materials and contaminated soils off-site at a RCRA-approved incinerator instead of excavation and treatment. | Treatability studies have shown that hydrolysis/proteolytic dechlorination could not achieve performance standards, and the incineration alternative is preferable in that remedial action can be implemented much more quickly and is much more cost effective than HPD. | Development and finalization of a Community Relations Plan; an informational repository was established; a fact sheet announcing the start of RI/FS was issued; two public meetings were held; and an advertisement was published in two of the local newspapers. |

| Site Name (Type/Region) Date | Remedy Selected in Original ROD | Nature of Remedy Change | Reason for Remedy Change | Community Involvement in Remedy Change Process |
|--|--|---|--|---|
| Summit National Liquid Disposal Service (PRP AMD/Reg. 5) 11/02/90 | Ground water extraction and treatment, using 220 extraction wells installed on a grid system; installation of a slurry wall to isolate the site, preventing clean ground water from migrating on site and contaminated ground water from migrating off site. | Site boundaries were expanded, and a new extraction system was adopted, using pipes and drains to collect ground water over an extended period of time from the southern and lower eastern and western perimeters. This system will prevent contaminated ground water from migrating off site and eliminate the need for the slurry wall. | Change was based on further site investigations. The amended remedy achieves long-term cleanup instead of containment of contaminants. | A public meeting was held on August 1, 1990. "In general, the public indicated that they concurred with the proposed remedy." |
| Anderson Development Co. (PRP AMD/Reg. 5) 09/30/91 | <u>In situ</u> vitrification (ISV) of contaminated surface soil, lagoon sludge, and lagoon clay. | Low temperature thermal desorption (LTTD) of contaminated surface soil, lagoon sludge, and lagoon clay, contingent upon successful demonstration of a full-scale treatability study. | PRP presented EPA with results of a bench-scale LTTD test after the 1990 ROD was issued. EPA Region 5, the State of Michigan, Superfund Innovative Technology Evaluation (SITE) program, and Superfund Technology Assessment and Research Team (START) program determined that further evaluation was appropriate. LTTD is expected to have a capital cost approximately one-half that of ISV. | A public meeting was held on September 12, 1991, at City Council chambers. Community expressed concerns about original remedy (ISV) due to its unproven nature, both from a cost and safety standpoint. |
| Crystal Chemical Co. (PRP AMD/Reg. 6) 06/12/92 | <u>In situ</u> vitrification (ISV) of contaminated soil. | On-site disposal and capping of contaminated soil. | Sole vendor of ISV technology notified EPA in July 1991 that the technology would be unavailable for an undetermined period of time while additional analytical and experimental work was performed on it. | A Technical Assistance Grant (TAG) was awarded. An informal open house was held near the site on February 20, 1992; a public meeting was held on March 19, 1992. |

| Site Name (Type/Region) Date | Remedy Selected in Original ROD | Nature of Remedy Change | Reason for Remedy Change | Community Involvement in Remedy Change Process |
|--|--|---|--|---|
| Woodbury Chemical Co. (PRP AMD/Reg. 8) 09/22/86 | Excavation, offsite transportation, and incineration of highly contaminated rubble and soil with disposal of residual ash; and backfilling with clean soil, regrading, and revegetation. | The scope of the cleanup is increased to include additional highly contaminated areas within the site as well as contamination in adjacent properties. GW monitoring is to continue for 3 years minimum. | During the RD, offsite contamination was found to be much more severe than previously suspected. This high contamination in several areas and in the runoff ditches appeared to stem from drum storage--not from the contaminated rubble. | A Community Relations Plan was developed to involve the public; public comment on FS; fact sheets distributed; bilingual information notices were distributed to nearby residents; EPA issued press releases and public notices announcing the activities. |
| Saunders Supply Co. (Fund AMD/Reg. 3) 09/27/96 | Excavation, treatment by dechlorination, and offsite disposal of the K001 sediments from a wastewater pond and a former earthen separation pond; excavation, low temperature thermal desorption treatment and offsite disposal of the site soils and the sediments from a storm sewer; treatment of groundwater during the dewatering process prior to excavating the soil that collected in the ground water collection trenches; removal of the top 1 inch of concrete pads, solidification of the removed material, and offsite removal; cleaning and sliplining of the storm sewer; ground water monitoring; and institutional controls. | Excavation and offsite incineration of the K001 sediments from the wastewater pond and former earthen separation pond; excavation and offsite incineration of the site soils and sediments from the storm sewer; and removal of the top 1 inch of the stained areas of the concrete pad in the area requiring soil excavation instead of all concrete pads. | Off site incineration would have fewer adverse impacts while being comparable in cost to onsite treatment; prior to the ROD VDEQ did not permit onsite disposal of soils containing RCRA-listed hazardous waste when the soils have been treated; soil sampling during the design phase indicated that only certain areas under the concrete pads required excavation and treatment; and during the remedial design concentrations of groundwater were found to exceed MCLs, and had migrated further than expected, so EPA conducted an emergency response to construct a system to collect and treat the groundwater to prevent further migration. | Documents pertaining to this site were placed in both the local and site repositories; a notice of availability of the documents was published in the Virginia Pilot and the Suffolk News Herald. A public meeting was held in the local fire house where EPA and VDEQ answered citizens' questions. A thirty day comment period was given. |
| Tenth Street Dump/Junkyard (Fund AMD/Reg. 6) 09/30/93 | Removing red clay cover and plastic liner; excavation of PCB-contaminated soil, followed by treatment of the excavated soil using chemical dechlorination and carbon adsorption to control air emissions; and backfilling and regrading excavated areas. | Excavation and capping of contaminated soil, institutional controls, and ground water monitoring were substituted for chemical dechlorination. | Chemical dechlorination was unsuccessfully employed at another site; RD contractor's estimate was more than twice the amount projected in ROD; and RD investigations showed 30% more soil contamination, no ground water contamination to date, and direct exposure as the only threat to human health and environment. | Technical Assistance Grant (TAG) group monitored project. No viable PRPs. |

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| Broderick Wood Preserving (Fund AMD/Reg. 8) 09/24/91 | Implementation of site access restrictions; excavation and onsite incineration of sludge and oil with offsite disposal of ash residues; excavation of visibly contaminated soils with either onsite incineration or onsite storage; wastewater filtering and treatment using carbon adsorption with onsite discharge or use in the incineration process; and GW monitoring. | Recycling of excavated sludge at permitted facility, offsite incineration of recycling residues, and offsite disposal of incinerator ash were substituted for onsite incineration. | RD indicated that onsite incineration would cost three to five times more than originally expected. Both the PRP and community were opposed to onsite incineration. | Public meeting was held. Notice was given. Public comment period was provided and comments were received from one of the PRPs (Brainard Investment Company). |
| Bunker Hill Mining & Metallurgical (Fund AMD/Reg. 10) 09/09/96 | Treatment of all principal threat materials (PTMs) at the site; cement- based stabilization to reduce the mobility of PTMs; and consolidation of PTMs under a simple, surficial cap. | Isolation of PTMs, except mercury, from the environment in a fully lined monocell. Mercury contaminated materials will still be treated prior to disposal. | EPA determined during the remedial design process that containment is more cost effective, has faster implementation, and exposes fewer on-site workers than stabilization/fixation. The revised remedy represents a 90 percent cost savings over the original ROD. | EPA issued two newspaper notices, a fact sheet, and a proposed plan; a public meeting was held on 8/15/96; and documents pertaining to this site were placed in both local and site repositories for public review. |